Novel Lightweight Magnets for Space Applications, Phase II

Completed Technology Project (2009 - 2012)

Project Introduction

The Tai-Yang Research Company (TYRC) of Tallahassee, Florida, will design, build and test a superconducting magnet system optimized for low current space based applications. Adiabatic demagnetization refrigeration (ADR) for milli-Kelvin sensor cooling is enabled by the use of superconducting magnets to eliminate ohmic heating. Present systems use low temperature superconductors and require significant cooling system power to operate the magnets. TYRC's proposed superconducting magnet will operate at higher temperature and lower current than systems presently available, and will therefore reduce the total system burden. In Phase I, TYRC successfully demonstrated a method for producing a high temperature superconductor optimized for the low currents (< 10 amps) required for space based magnets. In Phase II, TYRC will produce several small test coils from the optimized conductor to develop the manufacturing technology. TYRC will design a demonstration magnet with input from NASA personnel to address mission requirements. TYRC will then manufacture and test the demonstration magnet to validate the design. At the conclusion of the project, TYRC will be positioned to supply low current superconducting magnets optimized for space based ADR systems identified for NASA missions.

Anticipated Benefits

Potential NASA Commercial Applications: Low current high temperature superconducting magnets find application where weight savings and system power requirements are important. One such application is for magneto-optical imaging systems for studying low temperature material properties. TYRC has already produced a conceptual design for such a system using its novel, proprietary superconductor technology. The proposed coil technology is directly applicable to these systems, and may be introduced to this market during Phase II. NASA has licensed its ADR cooling system technology to a supplier interested in supplying such systems to research laboratories. TYRC's proposed coil technology may be used in these systems. Low current superconducting leads with higher temperature thermal intercepts may be of interest to cryogenic systems integrators seeking new methods of reducing heat leaks. TYRC's novel, proprietary conductor technology, now available, is directly applicable.

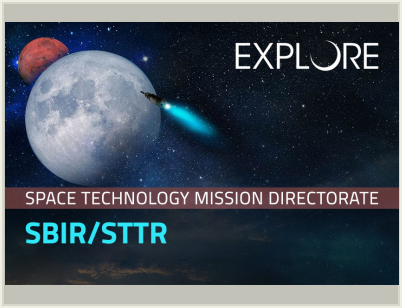

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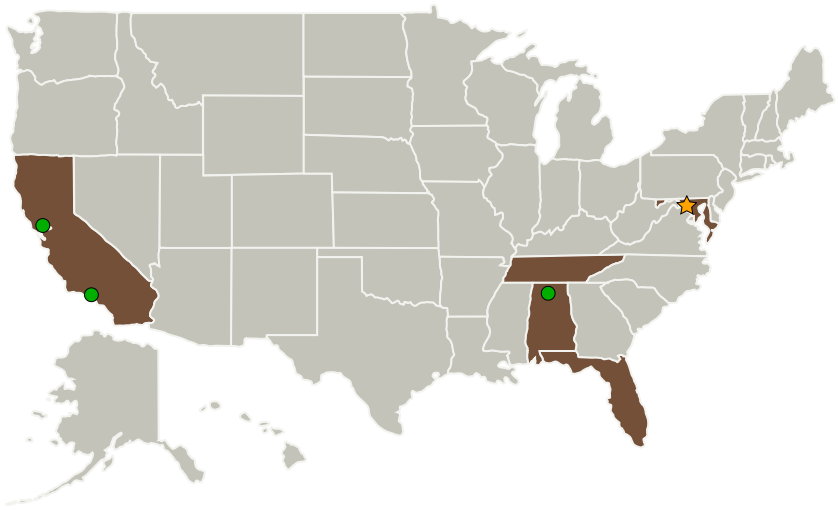
Table of Contents

Novel Lightweight Magnets for Space Applications, Phase II

Completed Technology Project (2009 - 2012)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
●Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Energy to Power Solutions	Supporting Organization	Industry	Tallahassee, Florida
●Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
●Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
Tai-Yang Research Corporation	Supporting Organization	Industry	Knoxville, Tennessee

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Gary C Jahns

Principal Investigator:

Trever Carnes

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Primary U.S. Work Locations	
Alabama	California
Florida	Maryland
Tennessee	

Project Transitions

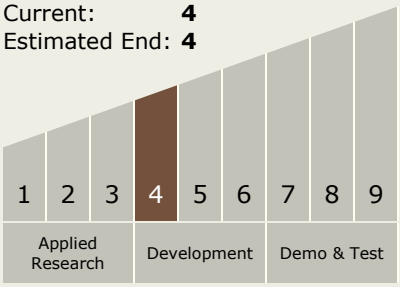
February 2009: Project Start

September 2012: Closed out

Closeout Summary: Novel Lightweight Magnets for Space Applications, Phase I I Project Image

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors